Verification Statement For Translation

I, Jung-Hyun KIM, hereby declare that I am conversant in the Korean and the English languages and that I am the translator of the document attached and certify that to the best of my knowledge and belief the following is a true and correct English translation of the specification contained in Korean Patent Application No. 10-2003-0050276 filed on July 22, 2003.

Signature: _____ Jung-Hyun KIM

Date: June 2, 2006

【Abstract of the disclosure】

【Abstract】

The present invention relates to a plasma display panel where dummy barrier ribs are provided at non-display area, thereby preventing the distortion of barrier ribs due to firing. The plasma display panel according to an exemplary embodiment of the present invention includes a first substrate and a second substrate facing each other, address electrodes formed on the first substrate, main barrier ribs arranged between the first substrate and the second substrate within a display area to form discharge cells, phosphor layer formed at the respective discharge cells, a plurality of discharge sustain electrodes formed on the second substrate, and dummy barrier ribs arranged at a non-display region sided with at least one end portion of the display area, wherein the dummy barrier ribs comprise main dummy barrier ribs proceeding in a direction of the display area, and interconnection dummy barrier ribs extended from the main dummy barrier ribs toward the main barrier ribs with a curvature and connected to the main barrier ribs.

【Representative drawing】

FIG. 3

【Keyword】

Plasma, Display, Main barrier rib, Dummy barrier rib, Display area, Dummy region, Address electrode, Discharge sustain electrode, Phosphor layer

【Specification】

【Title of the invention】

PLASMA DISPLAY PANEL

【Brief description of the drawings】

Figs. 1 and 2 are a partial exploded perspective view of a PDP according to an embodiment of the present invention, and a plan view thereof.

Fig. 3 is a partial plan view of the PDP shown in Fig. 1.

Fig. 4 is a partial plan view of the PDP according to the embodiment of the present invention, illustrating a first variation thereof.

Fig. 5 is a partial plan view of the PDP according to the embodiment of the present invention, illustrating a second variation thereof.

Fig. 6 is a partial plan view of the PDP according to the embodiment of the present invention, illustrating a third variation thereof.

Fig. 7 is a partial plan view of a PDP according to the prior art.

Fig. 8 is a cross-sectional view of the PDP taken along the A-A line of Fig. 7.

Fig. 9 is a partial plan view of the PDP according to the prior art illustrating the distortion of the barrier rib after the firing.

Fig. 10 is a sectional view of the PDP according to the prior art.

[Detailed Description of the Invention]

[Object of the Invention]

[Field of the Invention and Description of Related Art]

The present invention relates to a plasma display panel (PDP), and in particular, to a plasma display panel where dummy barrier ribs are provided at non-display area, thereby preventing the distortion of barrier ribs due to firing.

Generally, a plasma display panel (PDP) is a display device which excites phosphors with vacuum ultraviolet rays radiated from plasma obtained through gas discharge, and displays desired images by visible light generated by the excited phosphors. The PDP has been spotlighted as a flat panel display for next generation because the PDP with a high resolution can be made in a large screen size.

With the PDP, barrier ribs are disposed between a front substrate and a rear substrate as a stripe or lattice pattern, and discharge cells are defined by the barrier ribs. The PDP barrier ribs include main barrier ribs placed on the substrates within the display area where the display images are substantially made and dummy barrier ribs placed at the non-display area surrounding the display area.

Fig. 7 is a schematic view of main and dummy barrier ribs in a PDP according to the prior art. Fig. 8 is a cross-sectional view of the PDP taken along the A-A line of Fig. 7. As can be seen, the main barrier ribs 1 are formed with a stripe pattern. Dummy barrier ribs 3 contact the end portions 1a of main barrier ribs 1, and proceed perpendicular to main barrier ribs 1 (in the X direction of the drawing), thereby interconnecting the end portions 1a of main barrier ribs 1.

Barrier ribs 5 having main barrier ribs 1 and dummy barrier ribs 3 are

formed in desired pattern using the technique of screen printing, sand blasting, squeezing, or photo processing. With techniques where firing is needed, the patterned barrier rib paste is fired at 450°C or more. With the firing process, the impurities and the binder residue in the barrier rib paste are fired, and the barrier rib paste is hardened to form a hard barrier rib.

When the barrier rib 5 is fired, the paste-based film is contracted from its initial patterned state. The contraction proceeds along the direction of the length of the barrier rib 5. Therefore, the end portion 1a of main barrier rib 1, which is connected to the dummy barrier rib 3, is contracted toward the inside of the display area upon receipt of the contraction force (in the arrow direction of the drawing) directed thereto, and the dummy barrier rib 3 is contracted while resisting the distortion of main barrier rib 1.

Assume in relation to the drawings that the dummy barrier rib 3 is indicated by a, the end portion 1a of main barrier rib 1 connected to the dummy barrier rib 3 by b, and main barrier rib 1 placed within display area by c. The portion b of main barrier rib 1 is contracted and caved to a predetermined depth, due to the contraction force of the main barrier rib 1 and the resistance force of the dummy barrier rib 3. As shown in Fig. 8, the caved portion of main barrier rib 1 is indicated by reference numeral 7. Furthermore, with the firing process, the main barrier rib 1 and dummy barrier rib 3 is contracted, and as shown in Fig. 9, the corner portion of dummy barrier rib 3 is liable to be bent toward main barrier rib 1.

Accordingly, with the PDP having the above-structured dummy barrier

rib 3, the end portion1a main barrier rib 1 may not be formed in a uniform state. In particular, since main barrier rib 1 is concaved to a predetermined depth, height of main barrier rib 1 is varied depending on locations of main barrier rib 1.

According to experiments, when the height of barrier rib was set to be 147~150 μm before firing, the height of a portion, b portion, and c portion after firing was 140 μm, 110 μm, and 124 μm, respectively. Thus, as shown in Fig. 10, main barrier rib 1 is formed in different height along the direction of length of main barrier rib 1. Especially, gap 11 is made between main barrier rib 1 and front substrate 9 because portion b is concaved to a depth.

The unevenness of main barrier rib 1 induces vibration between front substrate 9 and rear substrate 13 while incurring noises, and this impairs the structural stability of the PDP.

[Technical Subject of the Invention]

According to an aspect of present invention, a plasma display panel is provided which prevent transformation of main barrier rib due to firing, thereby enhancing the evenness of barrier ribs.

In addition, according to another aspect of present invention, a plasma display panel is provided where a gap between main barrier rib and front substrate does not formed, thereby preventing noise generation.

[Detailed Description]

In accordance with the present invention, a PDP is provided which includes a first substrate and a second substrate facing each other, address electrodes formed on the first substrate, main barrier ribs arranged between the

first substrate and the second substrate within a display area to form discharge cells, phosphor layer formed at the respective discharge cells, a plurality of discharge sustain electrodes formed on the second substrate, and dummy barrier ribs arranged at a non-display region sided with at least one end portion of the display area, wherein the dummy barrier ribs comprise main dummy barrier ribs proceeding in a direction of the display area, and interconnection dummy barrier ribs extended from the main dummy barrier ribs toward the main barrier ribs with a curvature and connected to the main barrier ribs.

Preferably, the main dummy barrier ribs have a plurality of arc portions serially connected to each other, and the arc portions have substantially the same curvature as the interconnection dummy barrier ribs.

The dummy barrier ribs further comprise subsidiary dummy barrier ribs placed at the one-sided region of the main dummy barrier ribs facing the main barrier ribs. In this case, the subsidiary dummy barrier ribs are extended from the arc portions forming the main dummy barrier rib toward the main barrier ribs substantially with the same curvature as the arc portions.

In addition, separation barrier ribs are provided between the main barrier ribs and the dummy barrier ribs, and proceed substantially parallel to the main dummy barrier ribs.

According to another aspect of the present invention, a PDP is provided which includes a first substrate and a second substrate facing each other, address electrodes formed on the first substrate, main barrier ribs arranged between the first substrate and the second substrate within a display area to form discharge cells, phosphor layer formed at the respective discharge cells, a

plurality of discharge sustain electrodes formed on the second substrate, and dummy barrier ribs arranged at a non-display region sided with at least one end portion of the display area, wherein the dummy barrier ribs comprise main dummy barrier ribs proceeding in a direction of the display area and having arc portions serially connected to each other, and interconnection dummy barrier ribs extended from the main dummy barrier ribs toward the main barrier ribs with a curvature and connected to an end portions of the main barrier ribs.

Preferably, the arc portions of the main dummy barrier ribs have substantially the same curvature as the interconnection dummy barrier ribs. The dummy barrier ribs further comprise subsidiary dummy barrier ribs placed at the one-sided region of the main dummy barrier ribs facing the main barrier ribs. The subsidiary dummy barrier ribs are extended from the arc portions forming the main dummy barrier rib toward the main barrier ribs substantially with the same curvature as the arc portions.

Hereinafter, the detailed description of an exemplary embodiment of the present invention will be explained referring to the attached drawings.

Figs. 1 and 2 are a partial exploded perspective view of a PDP according to an embodiment of the present invention and a schematic plan view thereof, respectively.

As shown in the drawings, the PDP includes first and second substrates 2, 4 facing each other with some distance, and discharge cells 6R, 6G, 6B disposed between the substrates 2, 4. Each cell 6 has an independent discharge mechanism to emit visible rays, and display the desired color image.

Specifically, address electrodes 8 are formed on the inner surface of

first substrate 2 while proceeding in a direction (in the Y direction of the drawing). Bottom dielectric layer 10 is formed on the entire inner surface of first substrate 2 while covering address electrodes 8. Address electrodes 8 are stripe-patterned, and spaced apart from each other at a predetermined distance while proceeding parallel to each other.

Barrier ribs 12 are formed on bottom dielectric layer 10 while being stripe-patterned and proceeding parallel to address electrodes 8. Red, green, and blue phosphor layers 14R, 14G, 14B are formed on the lateral sides of barrier ribs 12 and on the top surface of dielectric layer 10. Barrier ribs 12 are disposed between address electrode neighbors 8 while proceeding parallel thereto. Barrier ribs 12 are standing between first and second substrates 2, 4 with a height to form a discharge space. The pattern of barrier ribs 12 is not limited to the stripe pattern, but may be formed with a lattice or other shapes.

Discharge sustain electrodes 20 are formed on the inner surface of second substrate 4 facing first substrate 2 in a direction perpendicular to address electrodes 8 (in the X direction of the drawing). Discharge sustain electrodes 20 include scan electrodes 16 and display electrodes 18. Top dielectric layer 22 and MgO protective layer 24 are formed on the entire inner surface of second substrate 4 while covering discharge sustain electrodes 20. Thus, the crossed region of address electrodes 8 and discharge sustain electrodes 20 forms discharge cell 6. Discharge cells 6R, 6G, 6B are internally filled with a discharge gas (a mixture of Ne-Xe).

In this embodiment, discharge sustain electrodes 20 are formed with a stripe pattern, and have a pair of bus electrodes 16a, 18a provided per the

respective discharge cells, and a pair of protrusion electrodes 16b, 18b extended from bus electrodes 16a, 18a toward inside of respective discharge cells 6R, 6G, 6B while facing each other. Protrusion electrodes 16b, 18b are preferably formed with a transparent electrode material, such as indium tin oxide (ITO), and bus electrodes 16a, 18a preferably with a metallic electrode material, such as silver (Ag).

Referring to Fig. 2, barrier ribs 12 are positioned at display area 26 defined on first and second substrates 2, 4. Furthermore, dummy regions 28 are existent at the non-display area surrounding display area 26 while centering around the display area and facing the opposite end portions of the display area (the top and the bottom sides of the display area in the drawing), and dummy barrier ribs are formed at the dummy regions 28. Hereinafter, barrier ribs 12 placed at display area 26 are referred to as main barrier ribs for convenience.

Dummy regions 28 are introduced to prevent the non-uniform discharge edge effect at the outermost discharge cell within display area 26. In this embodiment, dummy barrier ribs placed at dummy region 28 intrinsically prevents the misdischarging at display area 26, and in addition, inhibits the distortion of main barrier ribs 12 by caving some portion thereof when main barrier ribs 12 and dummy barrier ribs are patterned and fired at a high temperature.

Here, a reference numeral 30 indicates a clearance region, a reference numeral 32 indicates a terminal interconnection region, and a reference numeral 34 indicates an exhaustion port. In addition, a reference numeral 36 indicates a sealing member combining the first substrate 2 and the second

substrate 4 together.

Fig. 3 is a partial schematic plan view of the PDP shown in Fig. 1. As shown in Fig. 3, dummy barrier ribs 38 have main dummy barrier ribs 40 formed with a plurality of arc portions serially connected to each other in a direction perpendicular to main barrier ribs 12 (in the X direction of the drawing), and interconnection dummy barrier ribs 42 extended from the portions of main dummy barrier ribs 40 facing main barrier ribs 12 toward main barrier ribs 12 to interconnect main dummy barrier ribs 40 and end portions 12a of main barrier ribs 12.

Main dummy barrier ribs 40 are arranged such that the curvature center of the arc portions thereof is biased toward main barrier ribs 12. Interconnection dummy barrier ribs 42 can be extended from the arc portions forming main dummy barrier ribs 40 toward main barrier ribs 12 substantially with the same curvature. With dummy barrier ribs 38 having arc-patterned main dummy barrier ribs 40 and interconnection dummy barrier ribs 42 connected thereto, the width of main dummy barrier ribs 40 and interconnection dummy barrier ribs 42 is preferably established to be about 80 μm.

As described above, in this embodiment, dummy barrier ribs 38 have main dummy barrier ribs 40 and interconnection dummy barrier ribs 42, and are connected to end portions 12a of main barrier ribs 12. Dummy barrier ribs 38 are not formed with sharp edges, but with arc portions having a curvature. Particularly, interconnection dummy barrier ribs 42 are extended from main dummy barrier ribs 40 toward main barrier ribs 12 with a curvature to thereby

interconnect main dummy barrier ribs 40 and main barrier ribs 12 smoothly.

With the manufacturing of the PDP, when main barrier ribs 12 are contracted through the firing, interconnection dummy barrier ribs 42 move in the direction of the contraction of main barrier ribs 12 to prevent main barrier ribs 12 from being caved. Furthermore, the distortion of dummy barrier ribs 38 is minimized so that the shape uniformity can be obtained at end portions 12a of main barrier ribs 12.

Specifically, a barrier rib formation material is coated onto the top surface of bottom dielectric layer 10 of first substrate 2, and patterned using a technique of sand blasting, pressing, or etching based on a photoresist film such that it has main barrier ribs 12 and dummy barrier ribs 38. When the patterned is fired at a high temperature of 450°C or more, end portions 12a of main barrier ribs 12 move toward the inside of display area by the guidance of the force of contraction directed toward the inside of the display area (in the direction of the arrow of Fig. 3).

In this process, as interconnection dummy barrier ribs 42 of dummy barrier ribs 38 proceed toward main barrier ribs 12 with a curvature, end portions 12a of main barrier ribs 12 move toward the inside of display area together with interconnection dummy barrier ribs 42 to thereby prevent end portions 12a of main barrier ribs 12 from being caved. Consequently, main barrier ribs 12 are uniformly formed in the direction of address electrodes 8 with a height, and a gap is not made between the main barrier ribs and front substrate 4 with a resulting reduction of noise occurrence in the PDP.

Table 1 illustrates the front and rear-sided noise measurement results with respect to the PDP related to the Comparative Example (Fig. 7), and the PDP with dummy barrier ribs 38 related to the embodiment of the present invention.

Table 1

	Comparative Example	Example
PDP inner gas pressure (Torr)	650	650
PDP front-sided noise (dB)	43	35
PDP rear-sided noise (dB)	49	41

As listed in Table 1, it turned out that the front and the rear-sided noises were all reduced with the PDP according to the Example, as opposed to the PDP according to the Comparative Example.

Variations of the PDP according to the embodiment of the present invention will be now explained with reference to Figs. 4 to 6.

Fig. 4 illustrates a first variation of the PDP, which basically has the structure related to embodiment of the present invention. With this variation, subsidiary dummy barrier ribs 44 are further formed at the one sided region of main dummy barrier ribs 40, where dummy barrier ribs 38A face the main barrier ribs 12. As with the interconnection dummy barrier ribs 42, subsidiary

dummy barrier ribs 44 are extended from the arc portions forming main dummy barrier ribs 40 toward main barrier ribs 12 substantially with the same curvature. A pair of subsidiary dummy barrier ribs 44 are arranged between the two interconnection dummy barrier rib neighbors 42.

Subsidiary dummy barrier ribs 44 make dummy barrier ribs 38A harder, and during the firing of the barrier ribs, when main barrier ribs 12 are contracted toward the inside of the display area, subsidiary dummy barrier ribs 44 enhance the endurance of dummy barrier ribs 38A, and inhibit the distortion of dummy barrier ribs 38A. With the PDP having the varied structure, the shape uniformity of end portions 12a of the main barrier ribs is enhanced, and the quality of the PDP is heightened.

Fig. 5 illustrates a second variation of the PDP according to the embodiment of the present invention, which basically has the structure related to the first variation. Separation barrier ribs 46 are formed between main barrier ribs 12 and dummy barrier ribs 38B. Separation barrier ribs 46 are formed in a direction perpendicular to main barrier ribs 12 (in the X direction of the drawing) to interconnect end portions 12a of main barrier ribs 12, and like subsidiary dummy barrier ribs 44, make dummy barrier ribs 38B harder.

Fig. 6 is a third variation of the PDP according to the second embodiment of the present invention, which basically has the structure related to the second variation. Dummy barrier ribs 38C and separation barrier ribs 46 are sided with two other opposite end portions of the display area (at the left and the right end portions thereof based on the drawing) facing each other.

Dummy barrier ribs 38C and separation barrier ribs 46 are arranged at

the clearance region facing the left-sided end portion of the display area together with main barrier ribs 12. Main barrier ribs 12 are lattice-patterned with first barrier rib portions 12b proceeding in a direction of the address electrodes (in the Y direction of the drawing), and second barrier rib portions 12c proceeding in a direction perpendicular to the address electrodes (in the X direction of the drawing).

Dummy barrier ribs 38 and 38A to 38C, and separation barrier ribs 46 contact at least one of the upper and lower end portions and the left and right end portions of the display area. Particularly when main barrier ribs 12 are lattice-patterned, it is preferable that dummy barrier ribs 38C and separation barrier ribs 46 are arranged at the clearance regions facing the left and right end portions of the display area to inhibit the distortion at the left and right end portions of main barrier ribs 12, and main dummy barrier ribs 40 and separation barrier ribs 46 proceed in a direction perpendicular to second barrier rib portions 12c.

Although exemplary embodiments of the present invention have been described in detail hereinabove, it should be clearly understood that many variations and/or modifications of the basic inventive concept herein taught which may appear to those skilled in the art will still fall within the spirit and scope of the present invention, as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A plasma display panel comprising:

a first substrate and a second substrate facing each other;

address electrodes formed on the first substrate;

main barrier ribs arranged between the first substrate and the second substrate within a display area to form discharge cells;

phosphor layer formed at the respective discharge cells;

a plurality of discharge sustain electrodes formed on the second substrate; and

dummy barrier ribs arranged at a non-display region sided with at least one end portion of the display area;

wherein the dummy barrier ribs comprise main dummy barrier ribs spaced apart from the end portions of the main barrier ribs at a distance while proceeding in a direction of the display area, and interconnection dummy barrier ribs extended from the main dummy barrier ribs toward the main barrier ribs with a curvature and connected to the main barrier ribs.

2. The plasma display panel of claim 1, wherein the dummy barrier ribs are arranged at non-display regions sided with two opposite-end portions of the display area facing each other, and the main dummy barrier ribs proceed perpendicular to the address electrodes.

3. The plasma display panel of claim 1, wherein the dummy barrier ribs are arranged at non-display regions sided with two other opposite-end portions of the display area facing each other, and the main dummy barrier

ribs proceed parallel to the address electrodes.

4. The plasma display panel of claim 1, wherein the main dummy barrier ribs have a plurality of arc portions serially connected to each other.

5. The plasma display panel of claim 4, wherein the arc portions are convex toward the outside of the substrates.

6. The plasma display panel of claim 4, wherein the arc portions have substantially the same curvature as the interconnection dummy barrier ribs.

7. The plasma display panel of claim 1, wherein the main dummy barrier rib and the interconnection dummy barrier rib are connected to each other to form an arc portion.

8. The plasma display panel of claim 1, wherein the dummy barrier ribs further comprise subsidiary dummy barrier ribs placed at the one-sided region of the main dummy barrier ribs facing the main barrier ribs.

9. The plasma display panel of claims 4 or 8, wherein the subsidiary dummy barrier ribs are extended from the arc portions forming the main dummy barrier rib toward the main barrier ribs substantially with the same curvature as the arc portions.

10. The plasma display panel of claim 9, wherein the subsidiary dummy barrier ribs are arranged between the two interconnection dummy barrier rib neighbors pair by pair.

11. The plasma display panel of claim 1, wherein separation barrier ribs are provided between the main barrier ribs and the dummy barrier ribs.

12. The plasma display panel of claim 11, wherein the separation

barrier ribs proceed substantially parallel to the main dummy barrier ribs.

13. The plasma display panel of claim 1, wherein the main barrier ribs are stripe-patterned while proceeding parallel to the address electrodes.

14. The plasma display panel of claim 1, wherein the main barrier ribs are lattice-patterned with first barrier rib portions proceeding parallel to the address electrodes, and second barrier rib portions proceeding perpendicular to the address electrodes.

15. A plasma display panel comprising:

a first substrate and a second substrate facing each other;

address electrodes formed on the first substrate;

main barrier ribs arranged between the first substrate and the second substrate within a display area to form discharge cells;

phosphor layer formed at the respective discharge cells;

a plurality of discharge sustain electrodes formed on the second substrate; and

dummy barrier ribs arranged at a non-display region sided with at least one end portion of the display area;

wherein the dummy barrier ribs comprise main dummy barrier ribs spaced apart from the end portions of the main barrier ribs at a distance while proceeding in a direction of the display area and having arc portions serially connected to each other, and interconnection dummy barrier ribs extended from the main dummy barrier ribs toward the main barrier ribs with a curvature and connected to an end portions of the main barrier ribs.

16. The plasma display panel of claim 15, wherein the arc portions

of the main dummy barrier ribs have substantially the same curvature as the interconnection dummy barrier ribs.

17. The plasma display panel of claim 15, wherein the dummy barrier ribs further comprise subsidiary dummy barrier ribs placed at the one-sided region of the main dummy barrier ribs facing the main barrier ribs.

18. The plasma display panel of claims 17, wherein the subsidiary dummy barrier ribs are extended from the arc portions forming the main dummy barrier rib toward the main barrier ribs substantially with the same curvature as the arc portions.

19. The plasma display panel of claim 18, wherein the subsidiary dummy barrier ribs are arranged between the two interconnection dummy barrier rib neighbors pair by pair.

[Via ePMS only]

June 2, 2006

U.S. Patent Application No.10/822,134; Your Ref: Y35:52322; SDI Ref: G02501; Our Ref: OPP031070US

Dear Mr. Richard J. Paciulan:

Thank you for your letter of March 30, 2006, enclosing your comment regarding the outstanding Office Action dated March 6, 2006, and the reminders of May 19, 2006 and May 30, 2006.

With regard to your comments, please find enclosed verified English translations of both of the Korean Patent Applications, No. 10-2003-0023090 and No.10-2003-0050276, to which priority has been claimed.

Therefore, please prepare an appropriate response to the outstanding Office Action and file the same before the due date of June 6, 2006. Please do not hesitate to contact us if you have any questions during the course.

Thank you for your concern regarding this case, and please acknowledge receipt of this e-mail by return.

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